Chemistry Resource Binder

Course: SCH3U

Unit: Quantities in Chemical Reactions

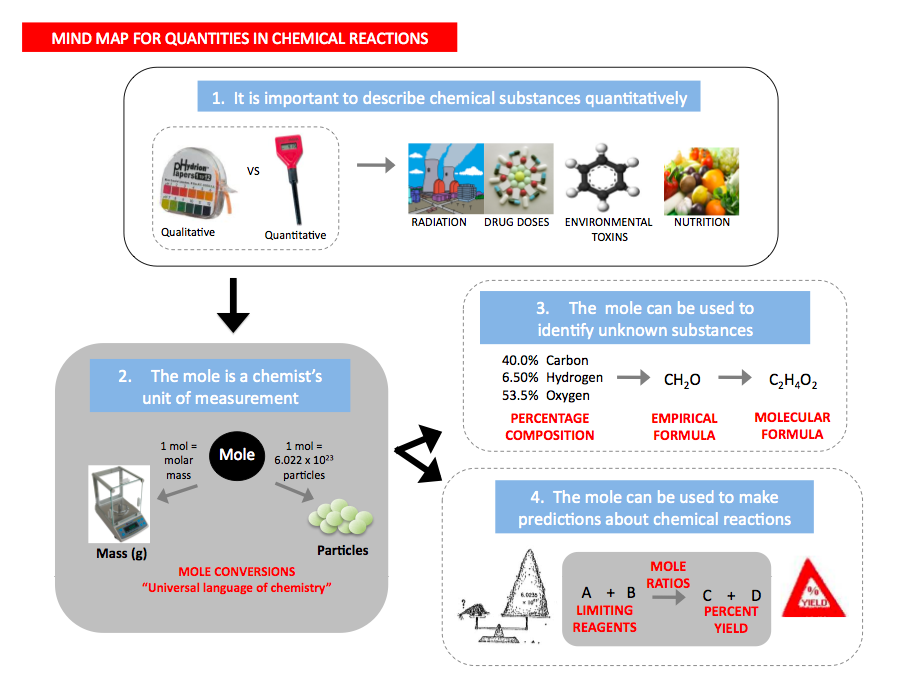
|  |  |  |  |
| --- | --- | --- | --- |
| Big Ideas and Expectations | | | |
| **Name of Unit:** | Quantities in Chemical Reactions (Strand D) | **Teacher(s):** | Rena, Shannon, Karen, Danielle |
| **Subject/Course:** | SCH 3U | **Grade Level:** | Grade 11 |
| **Other strands:** | Scientific Investigation Skills & Career Exploration (Strand A) | **Duration:** | 20 75-min periods |
| CURRICULUM SUMMARY | | | |
| **Driving Question:** | How are quantitative descriptions of Avogadro’s number, the mole, and molar mass related and why are accurate calculations important to health care professionals, the environment and society? | | |
| **Overall Expectations:** | A1. Demonstrate scientific investigation skills  A2. Identify and describe careers related to the fields of science under study and describe contributions of scientists, including Canadians, to those fields  D1. Analyse processes in the home, the workplace, and the environmental sector that use chemical quantities and calculations, and assess the importance of quantitative accuracy in industrial chemical processes  D2. Investigate quantitative relationships in chemical reactions, and solve related problems;  D3. Demonstrate an understanding of the mole concept and its significance to the quantitative analysis of chemical reactions | | |
| **STSE Specific Expectations:** | D1.1 Analyse processes in the home, workplace, and environmental sector that involve the use of chemical quantities and calculations  D1.2 Assess, on the basis of research, the importance of quantitative accuracy in industrial chemical processes and the potential impact on the environment if quantitative accuracy is not observed | | |

|  |  |  |
| --- | --- | --- |
| Key Components | | |
| Sections | Descriptions (brief) | Member Name |
| **Big Ideas with guiding questions** | This section outlines our big ideas for the overall unit, giving the bigger picture for the topics taught throughout the unit. In this section, we also address the overarching guiding question, which is what we refer to throughout the topics taught in this unit. | Rena, Shannon, Karen, Danielle |
| **Unit Plan** | This section demonstrates a calendar outline of our plan for teaching the entire unit. Here, we outline all of our lessons and topics, including the amount of days needed to cover the material. The unit plan also outlines areas of assessment and evaluation, along with activities and days for the STSE blog. | Rena, Shannon, Karen, Danielle |
| **Minds On Activity** | The mind’s on activity was designed as a “hook” for the entire unit. This will be carried out at the very beginning of the unit to capture the student’s interest and introduce the new topics in an exciting, engaging and intriguing way. | Danielle |
| **Misconceptions (4-5) for the unit** | Teaching chemistry to high school students comes along with many misconceptions since there are new abstract concepts that they have to wrap their heads around. This section describes some of the common misconceptions that students seem to encounter when learning about quantities in chemical reactions. A few examples include the mole, Avogadro’s number and using exponents in calculations. | Shannon (major)  Karen (minor)  Rena (minor) |
| **Activity 1** | This activity was designed for use at the very beginning of the unit when the mole is introduced. It would be used as a way to address the misconception of the mole and to introduce a new “chemistry language”. The students are also introduced to “counting particles by mass” by completing a weighing activity using skittles and jellybeans. | Shannon |
| **Activity 2** | This is a **60-70 min activity** that is meant to serve as a content review for solving mole calculations (mole conversions, mole ratios, and limiting reagents). This unit contains many multi-step calculation questions that can be confusing for students who struggle to understand abstract mathematical concepts. Coupling Rube Goldberg with Bingo helps students apply analogies and visual/kinesthetic cues to consolidate ideas and break large questions into smaller, more manageable portions. | Karen |
| **One STSE series of blog entries** | This activity engages students in applying and extending their knowledge and understanding of chemical quantities to various contexts such as science, society, technology, and environment. The STSE blog has 3 parts throughout the unit where students answer and discuss scaffolded questions with their peers. This 3-part activity will allow the teacher to assess prior knowledge, monitor student progress, and both teacher and students can engage in peer feedback. Most of all, this STSE activity helps students think about quantitative chemistry in different areas of their lives. | Rena (major)  Karen (minor)  Shannon (minor)  Danielle (minor) |
| **Lab experiment for classroom carousel** | We have designed an inquiry-based lab, where the students are responsible for devising a protocol for determining the empirical formula of magnesium oxide. We have scaffolded this lab with pre-lab questions and “hints” along the way so that the students are able to come up with their own procedure. They are then given an “actual” procedure and it is their responsibility to compare their designed procedure with the “actual” procedure for missing steps. The students are not able to carry out the lab until the teacher has approved their procedure. The students then carry out the laboratory, complete calculations and questions and then write a recommendation letter to a pharmaceutical company about the solution they found to the “antacid crisis” | Karen (major)  Shannon (major)  Rena (minor)  Danielle (minor) |
| **Summative Unit Test** | The summative test has been designed in a way to cover all areas of the achievement chart categories. All of the topics covered within the unit have been equally distributed throughout the test. The test has been differentiated in a way to incorporate choice for students. | Karen (major)  Shannon (major)  Rena (major)  Danielle (minor) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UNIT PLAN TIMELINE | | | | |
| Monday | Tuesday | Wednesday | Thursday | Friday |
| 1 | 2 | 3 | 4 | 5 |
| **Introduction to Quantities**  - Review – Metric conversions  - Qualitative vs Quantitative  **- STSE Blog – Part 1 (Quantitative Literacy)** | **What is the mole?**  - The mole as a unit of measurement in chemistry  **- Activity 1 = Candy+Mole AfL** | **1-step mole conversions**  - Avogadro’s number  - Conversion #1: n = N/NA | **1-step mole conversions**  - Molar mass – periodic table  - Conversion #2: M = m/n | **2-step mole conversions**  - Analogy that incorporates Conversion #1 and #2  **- STSE Blog – Part 1 Due AfL, AoL** |
| 8 | 9 | 10 | 11 | 12 |
| **Formative Quiz AfL**    **Percentage Composition** | **Law of Definite Proportions** | **Empirical/Molecular Formula – Part 1** | **Empirical/Molecular Formula – Part 2** | **Empirical/Molecular Formula**  - **Inquiry Lab – Part 1 -Initiating and Planning** **AaL** |
| 15 | 16 | 17 | 18 | 19 |
| **Empirical/Molecular Formula**  **- Inquiry Lab – Part 2 – Executing of design AaL** | **Empirical/Molecular Formula**  **- Inquiry Lab – Part 3 – Computer lab** | **Empirical/Molecular Formula**  **- Inquiry Lab Due AoL**  **- STSE Blog – Part 2 Due AoL**  **(Merck Frosst Letter)** | **Mole Ratios in Chemical Equations – Part 1** | **Mole Ratios in Chemical Equations – Part 2** |
| 22 | 23 | 24 | 25 | 26 |
| **Formative Quiz AfL** | **Limiting Reagents – Part 1** | **Limiting Reagents – Part 2** | **Percentage Yield** | **- STSE Blog – Part 3**  **(Predict/Measure Chemical Quantities)**  **Formative Assignment DUE AfL** |
| 29 | 30 |  |  |  |
| **Review for Unit Test AaL**  **Activity 2 = Rube Goldberg + Bingo Review**  **- STSE Blog – Part 3 Due AoL** | **Unit Test AoL** |  |  |  |

**Unit Plan Rationale**

The sequence of each topic within this unit allows for the expected time for students to grasp each concept thoroughly. For example, the class spends one week devoted to learning moles since this unit of measurement is new to them and is also required for subsequent lessons and units later on in the course. A formative quiz follows the week after to allow the teacher to assess for any misconceptions that students may have. The lessons that follow later build upon one another using the mole concept so students will have sufficient time for consolidating the concepts as well as responding to teacher and peer feedback and self-assessment.



**Misconceptions found within Strand D of SCH3U:**

***Quantities in Chemical Reactions***

This unit comes along with a few misconceptions that the student may face, since there are many new concepts introduced. Also, the students are introduced to a new “chemical language” in this unit, which is something that they may have difficulty taking in. This is an outline of a few of the misconceptions they may come across, along with some of the ways that we, as teachers, can address them.

1. *Do not assume that students know how to use* ***scientific notation***
   * Some students may not have a strong background with using exponents in calculations and may need to be taught/re-taught this
   * Also, since they are being introduced to Avogadro’s number (6.022 x 1023), which will be used in almost all calculations, students must have a clear understanding on how to enter this into their scientific calculator and how to use exponents on their calculator
   * One way to address this misconception would be to have a brief lesson on exponents, scientific notation and the use of a scientific calculator. It would be worthwhile taking an extra 30-40 minutes to refresh these ideas so they are not overwhelmed having to learn these basic math concepts in addition to learning a new chemistry language
2. *Specific abstract concepts (****mole, limiting reagent****) require concrete, hands-on activities*
   * In this unit, the students are expected to learn a new chemistry language, since there are many new chemistry terms introduced. A few examples include the mole, Avogadro’s number, the limiting reagent, empirical and molecular formulas etc.
   * Many of these terms seem like complicated concepts to grasp since they are spoken about in chemical terms, however, many of these concepts can easily be related to real life examples and this is one of the major ways we think these misconceptions should be addressed
   * At the very beginning of the unit, when the mole is introduced, we have designed an activity that helps students with the concept of the mole. They must come up with their own “unit of measurement”. They then make the connection that the mole is also just a new unit of measurement, but just a much larger number
   * We found that using real-life analogies to address the misconception about the limiting reagent would be a simple way to help students understand this concept. For example making smores or baking a cake with several ingredients, one of which is limiting.
3. *Misconception that* ***unit conversions*** *change the amount of a chemical substance present* 
   * Students may not understand that even though the units of a substance has changed, the *amount* still remains the same, e.g. 1 mol NaOH vs 40 g NaOH
   * Explaining unit conversions is to students and ensuring they have a solid understanding of this concept is essential for them to succeed in this unit.
   * We have designed an activity using the Rube-Goldberg exercise, where students must explain the steps in unit conversions by acting it out. We think that if students are able to ***explain******how*** they solve a problem, they will have a better understanding on how the units change throughout a problem.
   * Also, using real-life examples and analogies for unit conversions is another simple way for students to overcome this misconception that the amounts of substance changes as the unit changes. For example, a 1 dozen is the same at 12 eggs versus 1 mol of Na atoms is the same as 6.02x1023 atoms of Na.